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# DEVELOPMENT OF BUILDING MATERIALS AND CERAMICS INDUSTRIES IN UAR.

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# DEVELOPMENT OF BUILDING MATERIALS AND CERAMICS INDUSTRY IN THE UNITED ARAB REPUBLIC

When the national revolution rose in 1952, it was evident that the way to develop the country and to raise the standard of living lies only in taking the necessary measures to increase the production and to establish a strong basis for industry in the youthful Republic. Accordingly, a wise policy, aiming at the industrialization of the country, was laid down, and periodic schemes for economic and social development were drawn.

Needless to say that building and construction are the corner-stone for all the projects of the various sectors of the development schemes concerning production and services. Hence the important role played by the building materials and ceramics in realization of the development schemes was recognized, and a general organization was established to devote its activities to develop these materials and contrive new ones at low production costs and in appropriate quality and sufficient quantity to cope with the increasing demands of the new development projects.

The sector of the building materials and ceramics comprises about 170 factories for the production of cement, gypsum, bricks, pipes, sanitary ware, tiles, glass, refractories, etc. Of these there are about 17 modern mechanical factories (of a capital of L.E.15 million), belonging to the General Egyptian Organization of Building Materials and Ceramics, the rest of the factories being small private enterprises. This is apart from the other factory units producing construction steel, electric appliances, gypsum, wood, as well as quarries, products of building and ornamental stones, sand, gravel, etc.

It is worth mentioning that building materials and ceramics present a big section of the UAR national economy; the value of building construction being 2,500 million pounds.

The building and construction sector in the development schemes for production and services includes rebuilding the old villages and building new ones to meet the needs of the new reclaimed land areas for agriculture and to establish the newly formed industrial societies. The value of such projects was estimated to be 300 million pounds per year. To meet the

requirements of such projects from building materials and ceramics, schemes were drawn to increase the production of the present factories and to establish new ones.

Local building materials and ceramics consist mainly of:

1. Natural Stones for Building: such as limestone, sandstone, granite, marble ... etc. Till recently, marble worth one million pounds was imported every year. It is expected in the very near future, to increase the production capacity of the local marble quarries so as to attain self satisfaction. It is noteworthy that in spite of the abundance of natural building stones in the UAR, yet they are not favoured because of the great thickness and load of the walls built from them. In general, red building bricks are preferred to natural building stones.

2. Concrete

Concrete may be considered one of the most important building materials. It represents an appreciable ratio of the total cost of the building. The saving in its use has been the subject of many studies. As a result of some of these studies, it was possible to manufacture light weight concrete blocks from locally available materials.

3. Building Bricks

They include ordinary red brick, cement brick, sandlime brick ... etc. Bricks are considered the major constituent of the building volume in the UAR. Ordinary red bricks, made from Nile silt, represent about 90 per cent of the total bricks consumed in the UAR.

4. Pottery and Procelain Products

They include pipes, tiles, sanitary ware ... etc. Till recently, glazed tiles and sanitary ware were imported. Local production of these products started in 1961, and is increasing rapidly to meet the increasing local demands. This is apart from the increasing production of Enamelled Sanitary Ware.

5. Construction Steel, Wood and Glass

Most of our requirements from construction steel, sheet glass are now satisfied from the local production. Although increasing amounts of wood are locally produced from agricultural wastes, yet some of our needs are still imported.

6. Mortars, Paints and Varnishes

Most of our needs from paints, varnishes and special mortars are now manufactured locally.

7. Heat, Sound and Water-Proof materials

These materials find application only in special buildings. Most of these materials are manufactured locally.

8. Electrical Appliances

Local production of electrical appliances plays now an important role in coping with our increasing demands.

9. Prefabricated Building Units

Local production of prefabricated building units is now under consideration in the UAR to help in realizing the housing schemes in the villages in a short time and at a low cost. Several villages have recently been erected from complete prefabricated walls and roofs at Tahrir Province.

The following pages of the report presents a survey of the most important building materials and ceramics produced in the UAR together with the approved development schemes to cope with the local requirements.

These materials comprise:

I. Building Bricks.

II. Cement.

III. Cement Products.

IV. Refractories, Pottery and Porcelain.

V. Glass.

## I. BUILDING BRICKS

The important type of building bricks employed in the UAR are: ordinary red bricks (manually formed), wire cut bricks (extrusion formed); engineering bricks (mechanically pressed), sand lime bricks, cement bricks and sewer bricks. The popular dimensions are 25 x 12 x 7 cms. for bricks and 40 x 20 x 20 cms. for blocks.

### 1. Ordinary Red Bricks

This type represents about 90 per cent of the total bricks consumed in the UAR. The present local consumption from this type in about 2,000 million bricks/year, which is expected to rise to 3,000 million bricks/year in 1970. This is to cope with the increasing demands of the development schemes.

The ordinary bricks are made from Nile silt brought and precipitated along the banks of the Nile, during the flood season. Factories manufacturing this type of bricks are distributed along the Nile banks. In Cairo there are about 65 of these factories, which produce about 2 million bricks per day. This type of brick lacks exact regularity in shape and suffers from unsteady properties, due to the nonhomogeneity of the Nile Silt. Accordingly, it is not suitable for use as facing brick or in bearing walls - it is used only in the construction as partition walls in the conorete skeletons.

### 2. Wire-Cut Bricks (Extrusion formed)

This type of brick is formed by extrusion and is characterized by plain surfaces and reetitude of edges. It may be used as facing bricks. The compressive strength of this type of bricks is about 150 Kgms/$cm^2$.

### 3. Engineering bricks (mechanically pressed)

This type of brick is formed by mechanical pressing. It is characterized by low water absorption (8 per cent) and high compressive strength (400 Kgms/$cm^2$). It is employed in the construction of

bridges, dams, power stations and road paving. Local annual consumption from this type is 4 million bricks, which is expected to be doubled after the execution of the irrigation projects, specially after the High Dam.

4. Sand-Lime Bricks

This type is made from lime and sand. It is characterized by high compressive strength of about 120 Kgm/cm$^2$. Our local production of this type is about 20 million bricks per year.

5. Cement Bricks

This type is made from cement and sand or cement, sand and pebbles (or crushed stones). It is made in the form of perforated blocks. It is used in regions where ordinary bricks are not available. Our consumption of this type is limited.

6. Sewer Bricks

This type is manufactured by adding pyrolusite (manganese oxide mineral) to siliceous kaolin raw material, to help the vitrification during the firing process. It is characterized by its low water absorption ratio ( not more than 4 per cent) and high compressive strength (500 Kgms/cm$^2$) and high acid resistance (not more than 2.5 per cent).

It is expected in a few years time, after the construction of the High Dam, that most of the silt carried by the flood waters will be precipitated upstream of the High Dam and hence the brick factories will lack the principal raw material for the red brick manufacture. Accordingly the new development schemes for the brick industry were designed on the basis of employing alternative materials for the Nile silt to compensate the decrease in production of the ordinary red bricks and to cope with the increasing future demands. After complete studies of the regional distribution, the suitability and the economics of the different local raw materials for brick manufacture, clay, sand and lime were found to be the most suitable. Hence clay bricks and sand-lime bricks were selected as alternatives for the ordinary red bricks made from Nile silt.

The development scheme of the brick industry includes the erection of about 17 factories for sand-lime bricks and clay-bricks in different regions covering all consumption centres of the Republic. The production capacity of these factories is about 700 million building units. The capital of the whole project is about 10 million pounds.

It is noteworthy that the general trend in the new brick projects, in addition to the use of alternative raw materials to Nile silt, is the employment of the modern mechanical manufacturing methods and the production of perforated light weight and large volume building units. The main advantages of these new types of building units are:

1. Exact regularity of shape, ensured by the mechanical body formation, permits doing without exterior plastering of the walls, thus saving about 60 per cent of the cement used for the plastering processes.

2. The use of large volume building units helps to save an appreciable ratio of the mortar used for cementing the units. The ratio saved may reach 75 per cent if the volume of the building unit is incfeased to 4 times the standard volume of the ordinary red brick.

3. The use of perforated and light weight building units helps to minimize the loads on the basis of which the concrete foundation and skeleton are to be designed, thereby saving in the building costs. This is in addition to the heat and sound proof characteristics of this type of brick.

4. The mechanically shaped building units are characterized by relatively high compressive strength, thus permitting their use in the construction of bearing walls.

5. The handling of large volume and light weight building units is much easier than the standard ordinary bricks, and helps to minimize labour cost.

## II. CEMENT

The UAR was among the leading countries which manufactured cement and continued to develop this industry applying the most recent techniques and equipment. No wonder therefore, that the Egyptian cement enjoys a good reputation among native and foreign consumers because of its good quality, conformity with different international specifications and at the same time low price which competes with the lowest cement prices of the world. One of the main factors which helped to achieve this is that the raw materials necessary for this industry - like limestone, clay, gypsum, kaolin, sand ... - are available in great quantities and good qualities in numerous quarries near the greatest consumption centres.

The first cement factory was erected in 1900 in Maasara, a village near Cairo, with a production capacity of 100,000 tons/year of Portland cement. Now there are 4 large factories in the UAR with a production capacity of 2.5 million tons of cement per year. These factories produce six types of cement:

1. Regular Portland Cement

This type represents 60 per cent of the total production of cement. It conforms with the Egyptian, British, American, German and French specifications. It is used in all plain, reinforced and prestressed concrete structures. It is also used in the construction of concrete floors, roofs and roads.

2. Portland Blast Furnace Slag Cement (35 per cent slag)

This type represents about 33 per cent of the total production of cement. It is produced according to the Egyptian, British, American and German specifications. It is manufactured by grinding together 60 per cent Portland cement clinker, 35 per cent blast furnace slag, and 5 per cent gypsum. It is used, like Portland cement, in buildings, roads, mortars and all plain and reinforced concrete works. It is characterized by its resistance to sea water and low shrinkage.

3. Rapid setting Cement

It is manufactured by grinding Portland cement clinker to a high degree of fineness (specific surface of about 3,500 $cm^2/gm$). It needs only 25 per cent of the period required by the regular Portland cement for setting and hardening.

4. Sea water cement

This type of cement contains a comparatively lower ratio of tricalcium salicate and a higher ratio of tetracalcium alumino ferrite than the regular Portland cement. It is characterized by its resistance to sulphate and salt waters, and it is thus recommended for use in the foundations of structures subject to the action of sulphate waters and for use in the lining of petroleum wells.

5. Low heat cement

This type of cement contains a high ratio of the components of low heat of hydration - dicalcium silicate and tetracalcium alumino ferrite. It is recommended for big masses of concrete, like dams, to avoid any liability for cracks of any type type during setting and hardening. It is also characterized by its resistance to sea water. This type of cement was used in the construction of some parts of the project for electricity generation from Aswan Dam. The High Dam will also require about 140,000 tons of this type of cement.

6. White Portland Cement

The physical properties of this type of cement conform with the standard specifications of the physical properties of the regular Portland cement, but with greater fineness.(specific surface of 3,000 $cm^2/gm$.) and high degree of whiteness. This type of cement is manufactured from special raw materials like kaolin, white sand and iron-free-limestone.

The last 4 types of cements represent about 7 per cent of the total production of cement.

7. Mixed Cement (Karnak Cement)

This type of cement is manufactured by grinding 70 per cent Portland cement clinker, 25 per cent quartz sand, 5 per cent gypsum to a specific surface of 3,000 $cm^2/gm$. It conforms with the standard specifications of the physical properties of the Portland blast furnace slag cement 35. It is recommended to replace other regular types of cement in all scopes of applications except in the reinforced concrete.

It was decided to produce this type of cement after carrying out a complete study concerning the suitability of the Egyptian raw materials in the different regions for the production of this type of cement according to the required specifications. This project has realized many economic advantages, the most important of which are:

- The increase of the production capacity of the cement producing factories without the increase of the number of kilns, but with the efficient utilization of the surplus grinding capacities in the different cement factories. This increase helps to cope with the increasing demands for cement required for the development schemes.
- the lowering of the cost of building and construction.
- efficient utilization of our national resources of raw materials.

Development of Local Needs of Cement

One only need mention reinforced concrete foundations, walls, columns and girders for the construction of factories, schools, hospitals, houses, dams, bridges ... to realize the dependence of industrial and social development schemes on cement and its products.

By studying the figures of the production and consumption of cement in the UAR from year 1889 to the year 1965, it will be seen that the consumption of cement in 1889 did not exceed 3,000 tons, then increased gradually till it reached 100,000 tons in 1910, 413,000 tons in 1938, and 941,000 tons in 1952. It then continued to increase, but rapidly, till it reached 2,100,000 tons in 1965. This is to cope

with the increasing demands of the development schemes which were undertaken in the last few years. The per capita consumption from cement increased accordingly from 44 Kgms in 1952 to about 90 Kgms in 1965. It is expected that the per capita consumption will continue to increase steadily and rapidly till it competes, in the near future, with the analogous international figures.

The local production of cement kept pace with the developing local consumption. The local cement factories succeeded also in coping with the export needs as the Egyptian cement is exported to about 27 countries. The export figure in 1960 was 650,000 tons; and it is expected that this figure will rise rapidly in the coming few years when the new cement projects are executed.

The study of the future demands for cement, necessary for the projects of the development schemes, showed that the local consumption in 1970 will amount to 3,750,000 tons. This is in addition to the export needs in 1970 which are expected to reach one million tons. To self cope with these needs, the production capacity should be increased to 4,750,000 tons. As the present production capacity is 2,500,000, therefore the development scheme in the cement sector included enlargement projects to raise the production capacity of the present factories to 4 million tons/year in addition to the erection of two new cement factories of production capacity of 750,000 tons/year.

Table 1 shows the production capacities of the cement factories before and after enlargement.

TABLE 1

Production capacities of cement factories in the United Arab Republic

| | Factory | Present Production capacity(1965)tons | Production capacity after enlargement, tons |
|---|---|---|---|
| 1. | Torrah | 900,000 | 1,400,000 |
| 2. | Helwan | 940,000 | 1,440,000 |
| 3. | Alexandria | 300,000 | 500,000 |
| 4. | Tebbin | 360,000 | 660,000 |
| 5. | Suez | | 500,000 |
| 6. | Assyout | | 250,000 |
| | Total | 2,500,000 | 4,750,000 |

## III. CEMENT PRODUCTS

In Egypt there are many industries which depend on cement as the starting material and produce many important products such as:

1. Asbestos - cement products: high pressure water pipes, sewer pipes, sheets, plates ...

2. Reinforced concrete products: columns, stands and supports for electricity and irrigation networks.

3. Plain concrete products: blocks for harbour pavements and wave barriers, cement bricks, perforated cement blocks, artificial building stone, prefabricated concrete building elements.

The availability of these products facilitated the execution of many projects in the scopes of irrigation, drainage, and road construction. It also made possible many vital projects, like the construction of the electricity and potable water networks in the villages and further places.

4. Prestressed concrete sleepers for the Egyptian railways: This type of sleeper was firstly introduced in the Middle East in 1964, to replace the wooden sleepers, because the concrete sleepers are more durable and of less over-all cost and maintainance.

Table 2 shows the annual production capacity of Segwart Company - which belongs to the Egyptian General Organization for Building Materials and Ceramics, and which is specialized in the manufacture of these types of products.

TABLE 2

Annual Production Capacity of Segwart Company, UAR

| Products | Unit | Production Capacity |
|---|---|---|
| Asbestos - Cement Pipes | tons | 40,000 |
| Asbestos sheets and accessories | " | 10,000 |
| Concrete pipes and accessories | " | 17,000 |
| Concrete Columns and Accessories | " | 10,000 |
| Other concrete products | " | 10,000 |
| Refractories and Pottery | " | 15,000 |
| Rubber products | " | 100 |
| Total | tons | 102,100 |
| Concrete sleepers | Number | 500,000 |

The total sales of this company during the last few years reached 4 million pounds per year, of which about half a million pounds is the value of the exported sales.

The enlargement projects included in the Development scheme for this company are:

1. The first project: includes enlarging, renewing and improving of the present manufacturing units of the asbestos pipes and sheets, the concrete pipes and columns. The project also aims at improving the quality of the products to conform with the modern standard specifications, so as to satisfy the increasing local and foreign demands.

The production capacity of this project amounts to 59,000 tons, the value of which is about one million pounds, and will give chance of new work for 27 people.

2. The second project: includes the erection of a new factory in Upper Egypt, for the production of concrete pipes to cope with the increasing demands for desert and land reclamation for agriculture. The production capacity of this project is about 30,000 tons, the value of which is L.E. 315,000 and an increase in the man power of about 100 people.

## IV. REFRACTORIES, POTTERY AND PORCELAIN

### Refractories

Refractories are used in the construction and lining of the furnaces, kilns and boilers of our vital industries. They are much used in the iron and steel furnaces and in the other metallurgical industries and foundry processes. They are also employed in the kilns of many other industries such as glass, cement, pipes, bricks, tiles and sanitary ware. Refractories are used also in the chemical industries, boilers, power houses and other industrial and productive fields.

Hence, refractories are considered one of the most important supports for industry and production. Their importance is not only due to their value but also due to the vast and vital sector of industries depending on them. The value of this latter sector is estimated by an appreciable ratio of our national economy - about 350 million pounds. Refractories industry, keeping pace with the industrial development schemes, has progressed rapidly since 1952. Local production in 1951, which was about 10,000 tons/year, covered only 50 per cent of our total needs. The rest, which was largely special and high duty refractories, was imported. In 1964/1965, local production increased to 45,000 tons, over 400 per cent, that in 1951 - only 1,000 tons was imported. The new development scheme for refractories includes the increase of production capacity of refractories so as to cope with the future demands. Table 3 shows the amounts of refractories consumed by the different sectors of industry before and after the execution of the development schemes. It will be seen that the consumption of heavy industry comprising the metallurgical industries represents over 60 per cent of the total consumption of refractories. It will be seen also that the local consumption will increase after the execution of the development scheme by about 50 per cent. Accordingly, the refractories development scheme aims at coping with the future requirements and attaining self satisfaction, as is shown in Table 4.

TABLE 3

Consumption of refractories before and after the development scheme

| Consuming sector | Consumption, tons 1964/1965 | Consumption, tons after development scheme |
|---|---|---|
| 1. Metallurgical industries | 27,000 | 40,000 |
| 2. Boilers | 6,000 | 7,000 |
| 3. Cement | 3,000 | 4,500 |
| 4. Glass | 2,500 | 3,500 |
| 5. Other industries | 6,500 | 8,000 |
| | 45,000 | 63,000 |

TABLE 4

Production of refractories before and after development scheme

| Types of refractories | Present production (tons), 1965 | Production tons after Development Scheme |
|---|---|---|
| Silica | 1,500 | 3,000 |
| Chrome & Magnesite | 2,000 | 4,000 |
| Dolomite | 10,000 | 14,000 |
| High Alumina | 2,500 | 5,000 |
| Fireclay 40/47 | 8,000 | 12,000 |
| Fire clay 25/39 | 20,000 | 25,000 |
| Total | 44,000 | 63,000 |

Pottery and Porcelain

The development scheme concerning this sector of the pottery and porcelain includes increasing the production capacity of sanitary ware, glazed and ceramic tiles, electrical insulators... to cope with the future demands (Table 5).

The value of the refractories development projects is about 1.5 million pounds, while the value of the pottery and porcelain development projects is about 3.5 million pounds.

TABLE 5

Production of Pottery and Porcelain before and after Development Scheme

| | Product | Present Production tons | Production tons, after development scheme |
|---|---|---|---|
| 1. | Household ware | 2,000 | 3,500 |
| 2. | Sanitary ware | 2,000 | 5,000 |
| 3. | Glazed Tiles | 1,500 | 3,500 |
| 4. | Ceramic Tiles | 1,000 | 5,000 |
| 5. | Electrical insulators | 200 | 700 |
| | Total | 6,700 | 17,700 |

## V. GLASS

Although the first glass factory known in history was erected in Tel el Amarna in Egypt, about 5,000 years ago, yet the glass industry with its modern techniques was not known in Egypt till 1930 when the modern glass factory in Shoubra - Cairo was erected. At the end of the 2nd world war, automatic machines were employed in this factory for the production of sheet glass. In Alexandria, another factory was erected for the production of reinforced glass, glass wool and polystyrene reinforced with glass wool. There are also about 15 small glass factories for the production of household glass ware.

The development scheme concerning the glass industry includes the increase in the production capacity of the different glass products and the manufacture of new types of glass products like coloured glass containers, laminated glass, mirrors, heat-resistant and neutral glass for chemical and medicinal laboratories.

The large glass factories were amalgamated, after nationalization, in one company to which belongs now, a group of factories in Shoubra, Amiria, Dokki and Hadra in Alexandria. The Shoubra factories deal with the production of the different types of sheet and plate glass, household glass ware and containers. The Hadra factory deals with the flat and curved safety glass, glass wool and polystyrene reinforced with glass wool. Before 1970, Dekki factory will produce the insulating fibres from iron slag, also Amiria factory will produce the neutral and heat resistant glass. Table 6 shows the present production capacity from the different types of glass products.

TABLE 6

Present production capacity of glass products

| Factory | Product | Unit | Production Capacities |
|---|---|---|---|
| Shoubra | Manual and automatic products | tons | 16,000 |
| | Ordinary Sheet glass | tons | 15,000 |
| | Ornamented sheet glass | " | 8,000 |
| Hadra | Hard glass | " | 570 |
| | Glass wool (fibre) | " | 650 |
| | Glass wool (mat) | $m^2$ | 950,000 |
| | Polystyrene | tons | 10 |

The average value of the total sales during the last three years amounts to about 2 million pounds. It is expected that this value will reach - after the execution of the enlargement projects and the realization of the export target - about 6 million pounds.

The enlargement projects include the following five projects:

1. Enlargement in the production of raw and polished sheet glass

This project aims at the increase of the production capacity to cope with the increasing demands from sheet glass for the building and housing schemes, and for the new industries like motor cars and television sets.... The production capacity of the project is about 30,000 tons/year of which 5,000 tons are of polished glass. The project will also give chances of new work for 1,500 people.

2. Enlargement in the production of Transparent Glass

This project aims at the increase in the production of household glass ware and containers. The production capacity of the project is 16,000 tons and gives chances for new work for 400 people.

3. Production of Coloured Glass and Sodium Silicate

This project aims at the production of coloured glass containers to meet the increasing requirements of the pharmaceutical and beverages industries. It also aims at the production of sodium silicate to cope with the increasing demands of the soap industry. The production capacity of the project is 15,000 tons per year of coloured glass products and 10,000 tons per year of sodium silicate. The project gives new chances for work for about 520 people.

4. Production of Neutral and heat resistant glass

The project aims at covering the increase in the local consumption of neutral and heat resistant glass. The production capacity of the project is 2,500 tons and the project gives new chances of work for 300 people.

5. Production of short fibred glass wool and polystyrene reinforced with glass wool

This project aims at the production of products, like boats, furniture, caps, sanitary ware, automobile parts, pipes.... from polystyrene reinforced with glass wool. The project includes the production of shortfibred glass wool required for this process.

The production capacity of the project is 900 tons of glass wool and 150 tons of polystyrene. The project also gives new chances of work for 110 people.

## CONCLUSION

TABLE 7

Summary of New Development Projects in the Building and Ceramic Materials Sector

| | Division | Increase in production capacity | Total Cost L.E. million | New Chances for work |
|---|---|---|---|---|
| 1. | Bricks | 700 million building units | 10 | 2,632 |
| 2. | Cement | 3 million tons | 25 | 2,069 |
| 3. | Cement products | 210,000 tons | 7 | 2,254 |
| 4. | Refractories Pottery & Porcelain | 30,000 tons | 5 | 1,614 |
| 5. | Glass | 41,000 tons | 11 | 2,876 |
| | | Total | 58 | 12,445 |

It might be of interest to summarize, as indicated in Table 7, the development projects in the building and ceramic Materials Sector as a whole. It will be seen that the total cost of these new projects amounts to about 58 million pounds which represents about 400 per cent of the original capital of the group of companies undertaking these projects. The main targets of these projects, as has been indicated in the previous pages, are to cope with the increasing demands of the various sectors of the development scheme from building materials and ceramics, to attain self satisfaction and to open new fields for earning for the increasing population and at the same time increasing the potentialities of the Republic to build the industrial basis for a new and strong nation.

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